Traffic Safety and the 5.9 GHz Spectrum

Remarks by Heidi R. King, NHTSA Deputy Administrator

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How often do we have the opportunity, and the courage, to pursue a dream that can change our lives?

This time of year, many of us celebrate graduations of family and friends. We celebrate the success of young people who followed a vision set out years ago, long before we knew if they could be mathematicians or philosophers.

Young people who, with the support of people around them, have worked for years to complete a course of study. Graduations provide a time to appreciate the years of effort and to look ahead into all that those years of work made possible.

Today, we are at a moment in history that is very much like our graduation for intelligent transportation communications — vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I).

Twenty years ago, the United States had the extraordinary vision to begin the first steps on a journey toward developing intelligent transportation communications. We worked together to develop protocols, prototypes, lab tests and field demonstrations.

And today we are getting ready to graduate. After years of work, the nation has deployed 54 projects, and dozens more are preparing to launch.

Across the United States, thousands of devices are installed, the first steps toward making the vision our reality. Communities are installing vehicle-to-everything (V2X); vehicle manufacturers are planning to equip new cars.

Thank you for being here to celebrate all that we have accomplished as a nation to get to this point, to pursue the dream of safer more efficient transportation.

Secretary Elaine L. Chao and all of us at the U.S. Department of Transportation have three key priorities:

- Safety
- Infrastructure
- Innovation that prepares all of us for the future

Transportation communications — V2X — are all three. You could say that intelligent transportation communications are our top three priorities!

Digitization and connectivity have revolutionized our lives. This revolution continues to expand into transportation.

We are here today because transportation communications offer enormous potential benefits, benefits to individual drivers, businesses and the overall economy:

- To individual drivers who value convenience and the safety of their families;
- To businesses who value safety, efficiency in transporting goods, services and people; and
- To the economy — all of which depends on a reliable, cost-effective, efficient transportation network.

Today is about the benefits — and the value — to you, to me, to our communities.

I will speak a bit about these benefits, but I also want to tell you what we are doing at the Department of Transportation to support deployment of life-changing transportation technology.

At the U.S. DOT, we are committed to following the science, research and data to unlock the life-changing potential of intelligent transportation communications.

WHY IS TRANSPORTATION COMMUNICATION IMPORTANT?

It's not just cars talking to cars, or cars talking to stoplights, pedestrians and bicyclists. The vision is driven by what intelligent transportation communications, or V2X, can do.

Whatever we call it, if you take away one thing today, take away this: We must tell everyone about this transformative set of technologies and what they can do.

A couple of weeks ago, at a graduation celebration in Silicon Valley, I chatted with engineers and scientists that are building our next generation transportation technology. We spoke about driver assist and self-driving systems.

I asked, "When you are driving home at 2 in the morning and you get stuck at a red light, what do you think about a system in which your car could communicate with the traffic light and the light lets you through? Or that monitors and adjusts traffic flows during the day to optimize traffic flow and safety, minimizing traffic delays? That can see around corners, through barriers that are impenetrable to Lidar, radar and camera systems?"

These transportation engineers — the ones at the cutting edge of transportation technology — said, "Wow, that would be great! We should build that." Folks that are at the cutting edge don't know that this technology is here.

That we have deployed thousands of devices across the United States, using all channels of the spectrum dedicated to this purpose in 1999.

The good news is that we have built it. We are testing and deploying. But we need to tell the world about it. We need to tell the world that we have systems that:

- Allow cars, trucks, and buses to see around blind corners to avoid some of our most deadly and heartbreaking collisions;
- Will likely support the most efficient, safest and smoothest transportation system the world has ever imagined — traffic communicating with traffic lights to assure safe, smooth traffic flows; and
- Could be the key component that makes our dreams of self-driving transportation a reality. Lidar can't see through that building, or that truck on the corner, or the rows of traffic. But V2X can.

We are grateful for the vision of the Federal Communications Commission and others whose decades of work were completed last year, preparing us for this moment — readiness to deploy.

Now is the time to accelerate the deployment of these life-saving technologies as the V2X ecosystem has matured to production-ready.

The story of V2X reminds me of the movie, "Field of Dreams" (1989). In that movie, a character walking through his cornfield one evening hears a voice telling him that "If you build it, they will come." And although it seems crazy, he followed that vision, built a ball park, and indeed the public did come.

In 1999, the FCC allocated the spectrum for transportation safety. If you've seen the movie "Field of Dreams," the FCC's action in 1999 was akin to designating a cornfield for a future use.

It was nothing short of visionary and courageous to recognize the potential in a swath of spectrum, and to begin the work to design and build toward that vision. But there wasn't a magic wand, we had to figure out how.

In 1999, BlackBerry personal devices were launched for the first time. The first USB flash drives were developed. Amazon.com was five years old and was run out of an upstairs office on a street lined with pawn shops, a wig store, takeout food and a heroin needle exchange. Jeff Bezos's desk was a door propped up on legs. At Bell Labs, we dreamed of 3G.

At that time, the necessary communication standards did not exist for V2X. The equipment didn't exist. In fact, wireless area networks were brand new! So the engineers got to work.

In 2003, the FCC adopted licensing and service rules for Dedicated Short-Range Communications — DSRC — operating in the 5.9 band. These rules were updated again by the FCC in 2006.

From 2004 through 2012, the Institute of Electrical and Electronics Engineers (IEEE) worked on standardizing the V2X wireless communications for vehicles under the 802.11 family of standards, and developed the applications and security standards for V2X in their 1609 standards family.

By 2016, the SAE completed specifying standards governing performance requirements and data elements for the V2V devices – the first time that a stable set of standards were available for the entire V2X ecosystem!

In 2017, after the completion of the standards, V2X certification services became commercially available for V2X devices.

In 2018, V2X communications security services, which have been a challenging piece of the V2X puzzle, became commercially available.

So, all the pieces are now falling into place!

Today, in 2019, we are ready to move forward building on the vision and the hard work that prepared us for this moment.

AT DOT, WE ALWAYS START WITH SAFETY

I'd like to say that I don't have to remind you, but the fact is that I do — more than 37,000 friends and neighbors are killed needlessly in traffic crashes every year.

In addition to the devastating human toll and suffering from motor vehicle crashes, the American taxpayer supports more than $140 billion per year in costs for emergency response, fatalities, injuries, and property damage related to vehicle crashes.

Intersection crashes are the most costly crash type when measured in economic terms, accounting for about 22% of the total motor vehicle crashes.

These crashes are not particularly well served by conventional sensors, and is where V2X technology can be particularly advantageous.

Neither LIDAR, radar, cameras or any light-based technology can see around corners, but V2X can. Radio-based technologies are the only option to detect objects that are not within the line of sight.

NHTSA estimated that full adoption of only two V2X safety applications would prevent about half a million crashes and save about 1,000 lives a year.

Only V2X can see around corners. To improve the safety of the existing auto landscape, and also to capture the full safety benefit of self-driving cars, we need V2X.

With V2X, we can improve safety for vulnerable road users. In 2017 there were over 5,000 fatalities in motorcycle-involved crashes and approximately 6,000 pedestrian-related fatalities. These two categories alone account for almost 30% of all motor vehicle-related fatalities.

V2X applications have the potential to significantly reduce these types of fatalities. This is a particular strength of V2X technology, since it does not rely on line of sight for detecting objects.

Efficiency

I grew up in California, where we seem to live in our cars.

More than 30 years ago, I remember sitting at a stop light on Crown Valley Parkway in South Orange County, and seeing the activities of the people around me: shaving, putting on makeup, eating. Drivers were distracted before smartphones. People have long wanted to make better use of their time in cars.

We know this is true more than ever today because of the keen public interest in self-driving cars, and the potential for us to take our work with us on our digital devices and to make calls, take video conferences, and produce digital work products in transit.

A friend of mine, a busy professional at a tech company, is planning to have her first child. She asked me if she will be able to buy a self-driving car so that she can care for her child in the car when she is stuck sitting in heavy California traffic. I had to tell her, not yet.

But thanks to V2X, perhaps platooning will be a part of the new intelligent transportation system.

Congestion

In 2017, congestion in the United States cost $305 billion, an increase of $10 billion from 2016.

Congestion takes the biggest economic toll on the largest, most economically vibrant cities in the United States.

V2X applications such as dynamic traffic signal control and prioritization have the potential to reduce travel times by up to 27%.

Today, we waste more than 3 billion gallons of fuel and keep travelers stuck in their cars for nearly 7 billion extra hours – 42 hours per rush-hour commuter. The total nationwide price tag: $160 billion, or $960 per commuter.

We know this time is valuable. We know this fuel is valuable. Not only does V2X give us safety and give us that precious time back, but we can reduce fuel use and reduce emissions from the tailpipe as well.

V2X can help address a significant portion of this $500 billion to $600 billion lost each year to motor vehicle crashes and to congestion.

U.S. DOT IS WORKING TO SUPPORT V2X DEPLOYMENT

At the U.S. Department of Transportation, we are actively engaged in supporting deployment of transportation communication technologies that will provide these tremendous safety and efficiency benefits.

Research

Because transportation communications technologies continue to improve, we continue performance testing.

We have worked for years to understand the strengths of DSRC, and now we are doing the same for cellular V2X. Our U.S. DOT team has developed a draft test plan for evaluating the performance of C-V2X technology, which includes:

- Basic Characterization Testing – Transmission of basic safety message, SPaT, MAP
- Interference Testing – DSRC, C-V2X, Wi-Fi operating in adjacent channels/bands
- Scalability Testing – Large number of devices in close proximity
- Interoperability Testing – Multiple devices from different vendors
- Scenario Testing – Selected application scenario testing (intersection, forward collision)

Testing is planned at Aberdeen, Maryland; Boulder, Colorado (National Telecommunications and Information Administration facility), and McLean, Virginia (Turner-Fairbank Highway Research Center). We are currently targeting June/July 2019 for initiating the C-V2X testing.

In addition, the U.S. DOT is working with NTIA's Institute of Telecommunication Sciences in Boulder, Colorado (ITS Boulder) and industry providers of new C-V2X devices to test and understand their performance for V2X safety, including testing interoperability and interference mitigations, as well as operations within conditions that are similar to a real-world transportation environment.

Characteristics of sharing spectrum are also important. We also know that spectrum is a valuable resource, and that is why the DOT and FCC agreed to complete three phases of testing to inform DSRC/Wi-Fi sharing.

The U.S. DOT is partnering with the FCC, the NTIA, and the U.S. Army at Aberdeen to conduct closed-course testing of prototype Wi-Fi devices equipped with technologies designed to share the 5.9 spectrum in a manner that would not interfere with V2X communications.

The Phase 2 track-based testing is a natural follow-on to the excellent Phase 1 laboratory-based research conducted by the FCC.

In Phase 2, U.S. DOT will test the two leading approaches for spectrum sharing—specifically, detect-and-vacate and re-channelization methods.

Testing will involve positioning prototype Wi-Fi devices in simulated real-world settings and operating V2X vehicles in their vicinity.

V2X communications performance will be measured with and without the spectrum-sharing technologies engaged to determine the effectiveness of such technologies in mitigating or eliminating potential interference.

If results of this Phase 2 testing confirm spectrum sharing technology potential, the examination would move into a third and final stage, which would involve larger scale testing of the spectrum-sharing technologies in real-world naturalistic settings.

Phase 3 will inform whether sharing and detect-and-vacate work in real-world settings, with mixed traffic, urban canyons of tall buildings, and a jungle of other devices.

Phase 2 is happening now. The U.S. DOT team has developed a draft test plan for Phase 2 effort that has been shared with the FCC and NTIA.

Phase 2 Test Plan includes testing a number of primary scenarios:

- Outdoor Wi-Fi access point
- Indoor Wi-Fi access point
- In-vehicle Wi-Fi access point and in-vehicle client devices
- Separate tests for detect-and-vacate and rechannelization sharing approaches

As technology evolves, we must follow the research and the data together to preserve current critical uses.

We are also working on Military Radar Interference Testing.

The U.S. DOT and the Department of Defense are planning additional testing to evaluate if Wi-Fi and C-V2X radio technology operating in 5.9 GHz creates harmful interference with military radar deployments, which are a co-primary user of the 5.9 band.

Grants

Congress has made funds available to continue to develop advanced safety technology.

Over the past 20 years, the U.S. DOT has invested over $700 million in research and development of V2X through partnerships with industry and state/local governments. The Department is committed to continued investments to further V2X transportation technology using existing Federal grant programs.

The INFRA Grant program provides dedicated, discretionary funding for projects that address critical issues facing our nation's highways and bridges.

The BUILD Transportation Discretionary Grant program provides a unique opportunity for the DOT to invest in road, rail, transit, and port projects with significant local or regional impact.

SO WHAT NOW?

Enjoy hearing from your colleagues today, and don't stop dreaming — and building!

I remind each of you: Ultimately, markets serve the public, and governments serve the public. While we see all the signs that the benefits to the public are great, the public needs to know that this dream has become real. You and I must engage the public and broader industry on the benefits of V2X to drive market demand.

Consumers have shown they want crash avoidance systems and will pay extra for them, for example, rear view cameras and blind spot warning systems.

Original equipment manufacturers have made significant progress on installing automatic emergency braking as standard on all vehicles under the 2017 voluntary agreement. This is further evidence that consumers appreciate and are willing to pay for crash avoidance technologies.

V2X technologies could follow a similar deployment path, but we need widespread public awareness.

If we build it, they will come.